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OCR A Level Computer Science

H446 – Paper 1

3

Network security and threats

Unit 5

Networks and web technologies

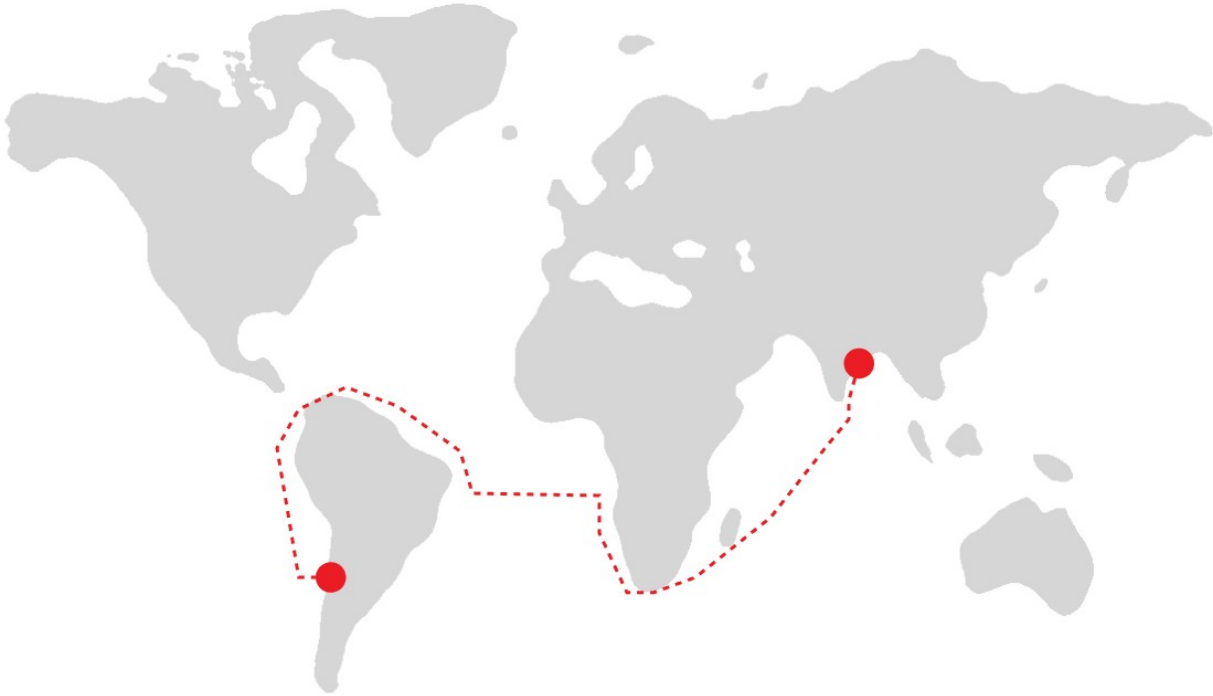
PG ONLINE

Objectives

- Discuss network security and threats
- Discuss use of firewalls, proxies and encryption
- Discuss worms, Trojans and viruses and the vulnerabilities that they exploit

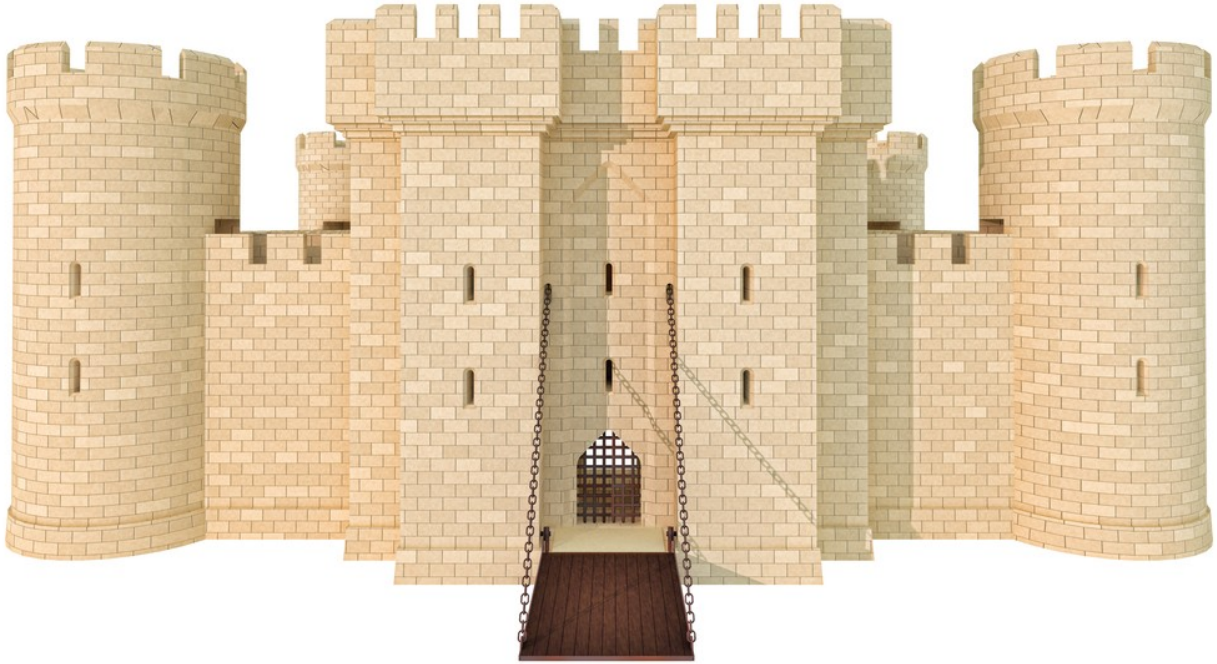
Starter

- A file is being transferred from Chile to India
  - What risks are involved in sending confidential information within the file?



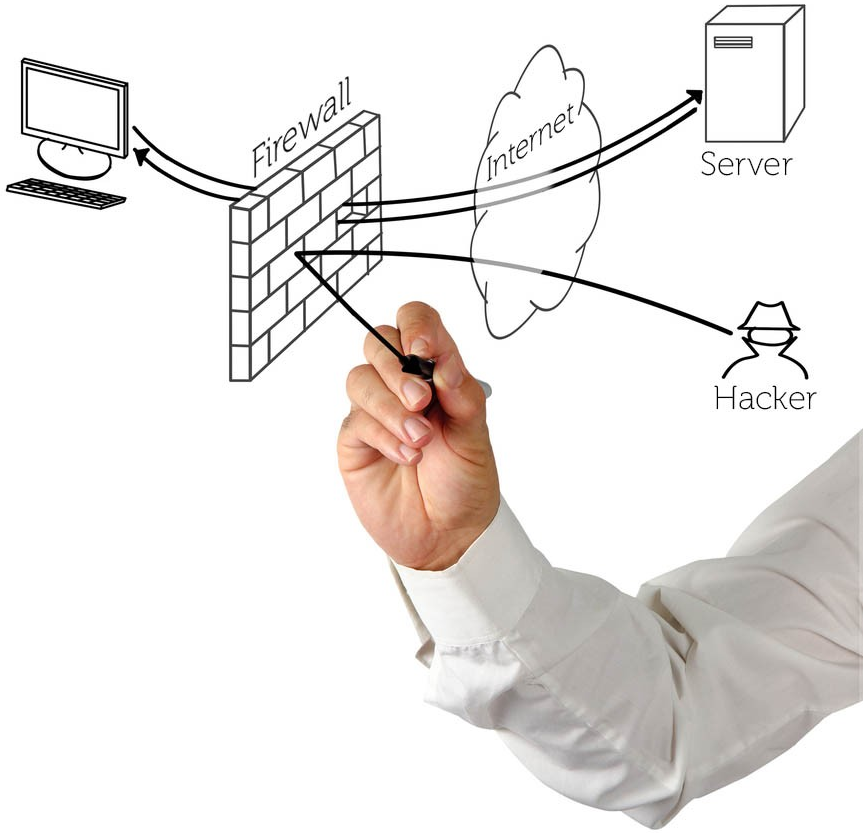
Castle security

- How can you get in or out of a castle?
  - What can you do to stop people entering or leaving?



Firewall

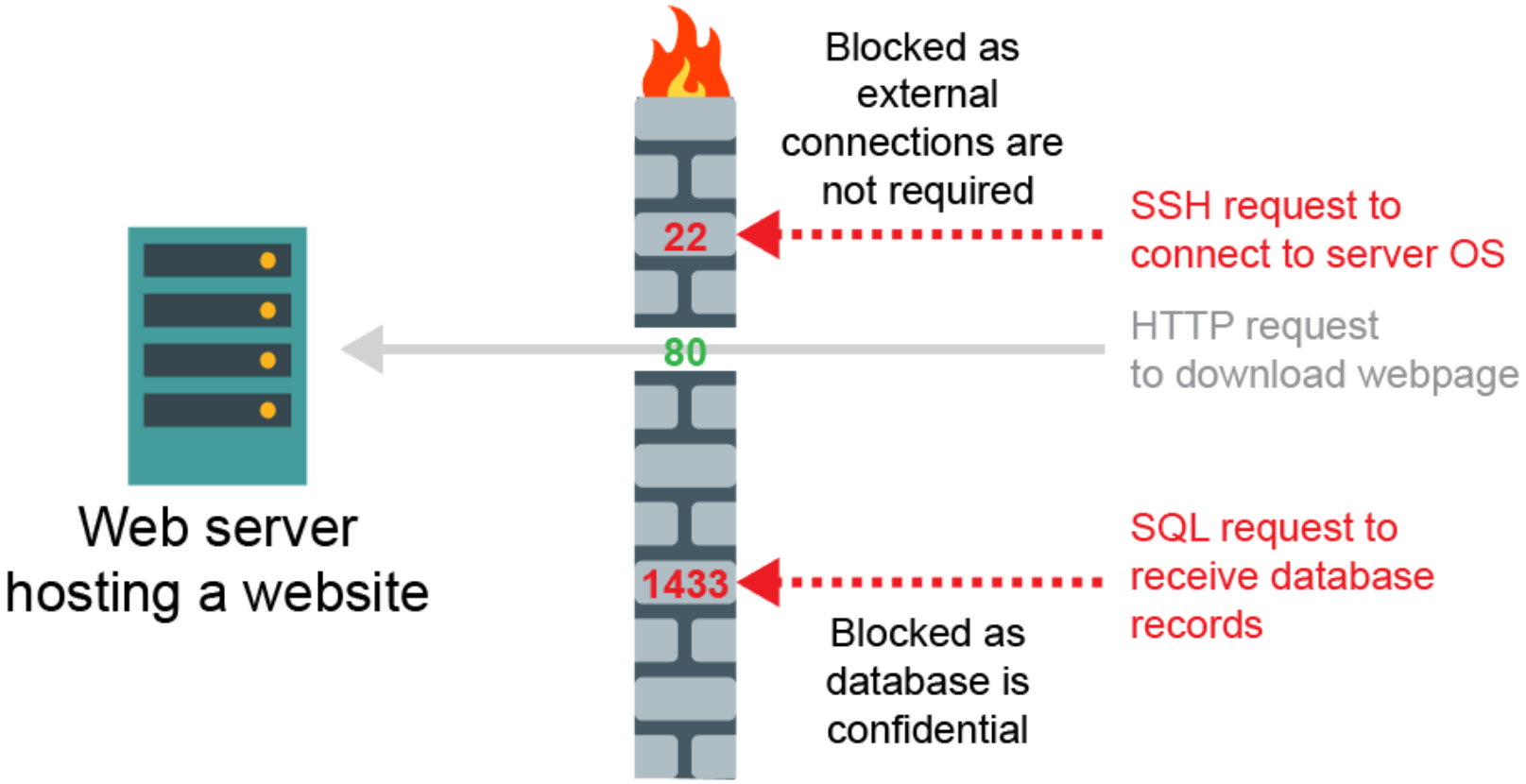
- The entrance to a network can be protected in the same way
  - A firewall is either software or hardware that controls access to and from a network
  - Numbered doors called **ports** are opened so that only certain traffic is allowed to pass through



Packet filtering

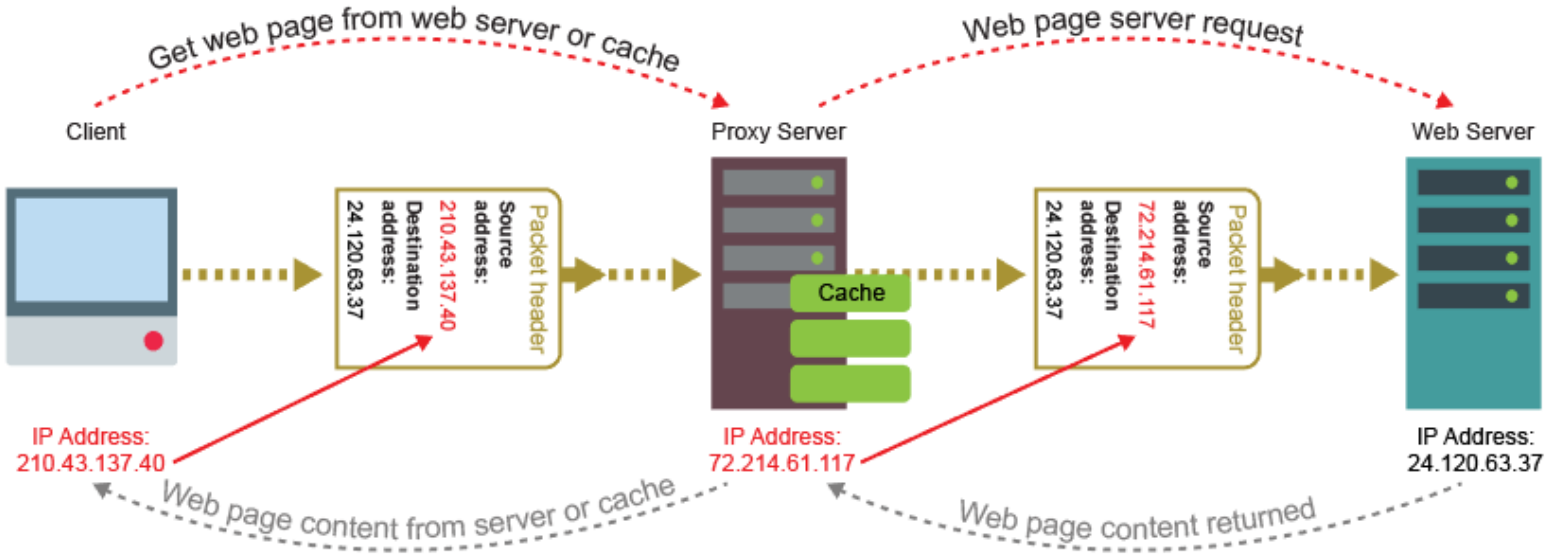
- Packets of data are inspected by the firewall to check which port they are attempting to access
- Different network protocols use different port numbers for example, HTTP traffic, used to transfer web page data, uses port 80 or 8080
- If this traffic is to be allowed through, the port must be opened for the duration of the connection, otherwise the firewall will automatically reject it
    - Why are ports not left open by default?

Blocking communications



Proxy servers

- 'Proxy' means *'on behalf of'*
  - A proxy server makes a web request on behalf of your own computer, hiding the true request IP addresses from the recipient



Functions of a proxy server

- A proxy server:
  - Enables anonymous surfing
  - Can be used to filter undesirable online content
  - Logs user data with their requests
  - Provides a cache of previously visited sites to speed access
- What happens if the website has been updated since the cached version?

Worksheet 3

- Complete **Task 1**

Encryption

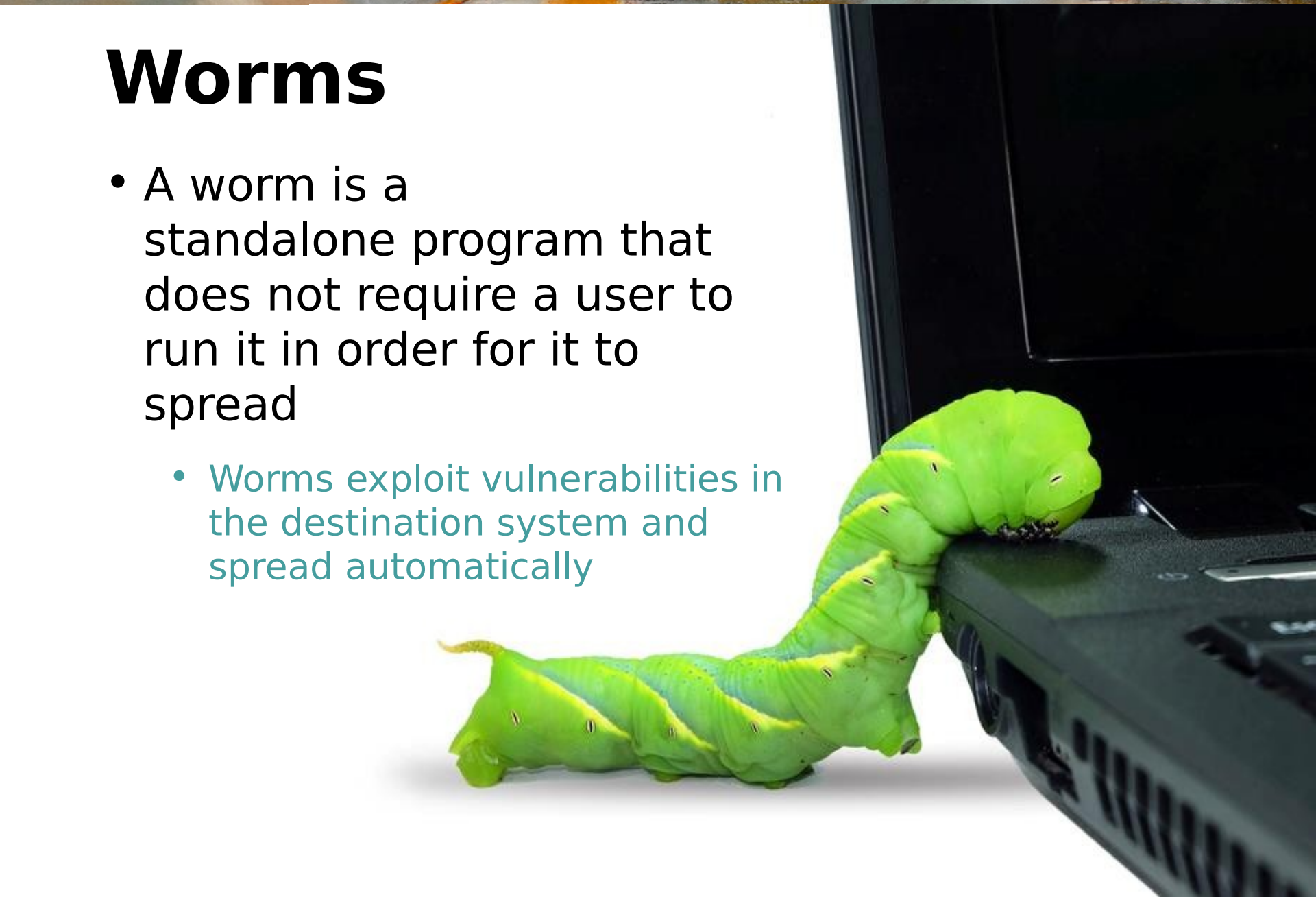
- The act of encoding a plaintext message so that it cannot be deciphered unless you have a numerical key to decrypt it
  - If the message is intercepted it cannot be understood
  - If the key can be intercepted, the encryption process is rendered useless
  - (Encryption is covered in much greater detail in Unit 4)

Malicious software

- Malware annoys users or damages their data
- Worms and viruses self-replicate
- A virus infects (embeds itself in) other programs or data files
- A virus needs a user to help it spread
  - It is commonly found in email attachments with Macros

Worms

- A worm is a standalone program that does not require a user to run it in order for it to spread
  - Worms exploit vulnerabilities in the destination system and spread automatically

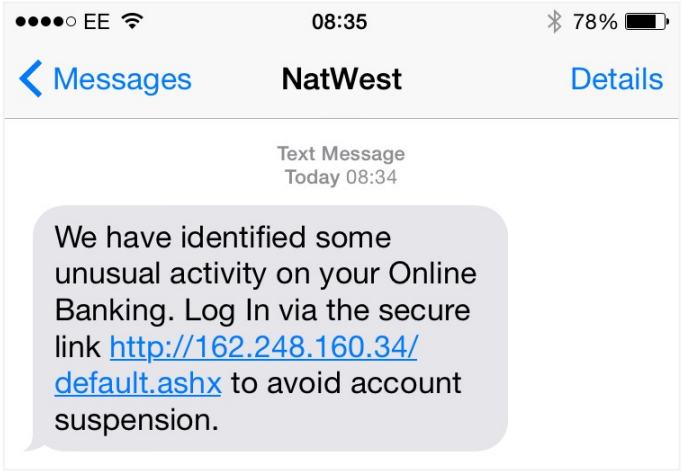


Trojans

- Trojans are malicious software programs that masquerade as innocuous or useful applications
  - They cannot self-replicate
  - Often they serve to open up back doors in your computer to the Internet so that the processing power, Internet bandwidth and data can be exploited remotely

Phishing

- Phishing is using email to manipulate a victim into visiting a fake website and giving away personal information
  - Who is most susceptible to such messages?
  - What are the consequences of clicking on such a link?

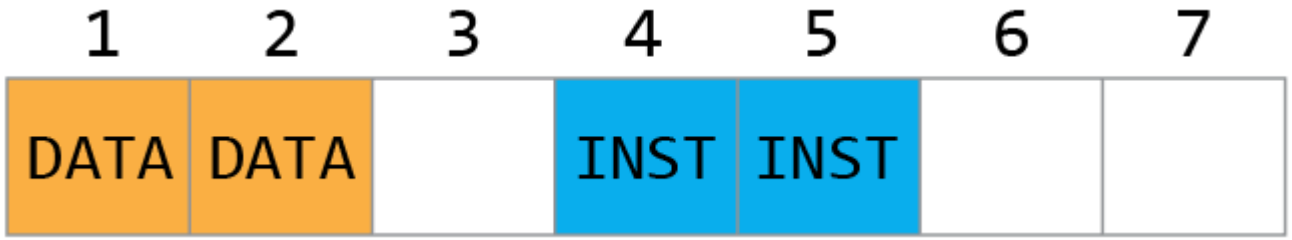


Code quality

- Improving code quality, together with monitoring attempts to gain unauthorised access and protection can significantly reduce threats from malware
- Measures include:
  - Guarding against buffer overflow attack
  - Guarding against SQL injection attack
  - Use of strong passwords for login credentials
  - Two-factor authentication
  - Use of access rights (file system permissions)

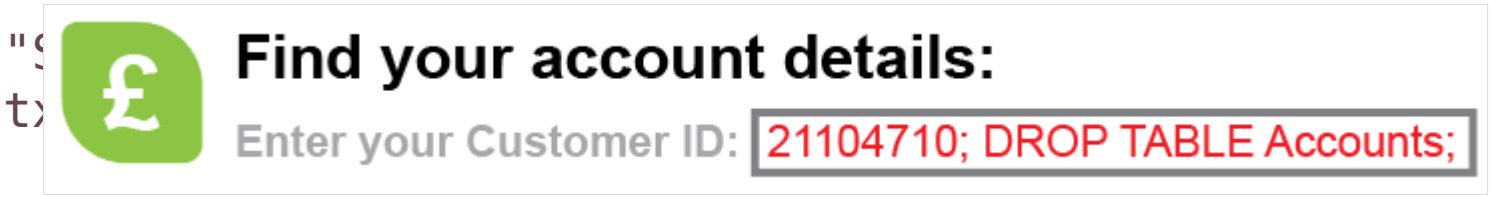
Buffer overflow

- Buffer overflow occurs when a program accidentally writes data to a location too small to handle it
  - As a result the overflowed data (written to location #3 below) may end up in a neighbouring instruction space
  - Malware can d…use and manipulate overflow data …en be read as a malicious 'instruction'



SQL injection

- A malicious user can enter SQL commands via online database forms to change the processing
  - Imagine the following SQL for a banking web form below:



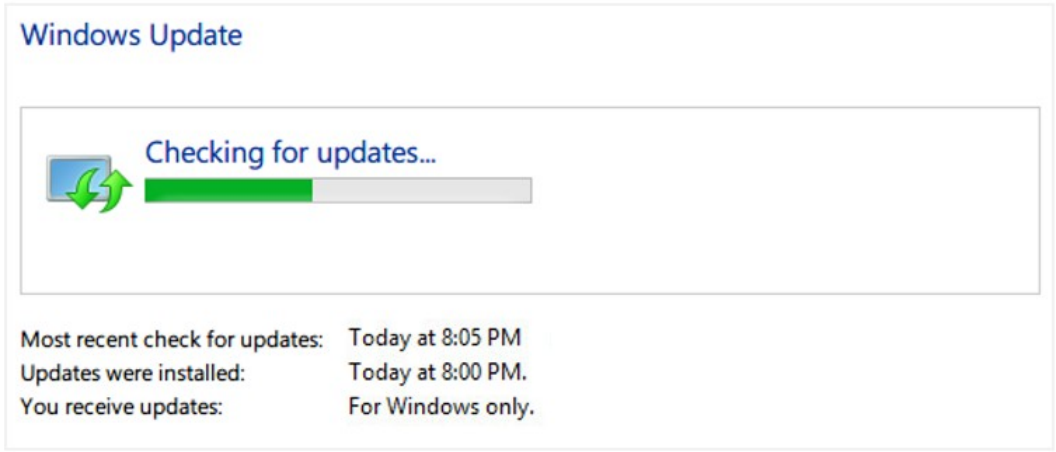
  - This will produce the following SQL to display the correct account details, then delete the bank's entire accounts data

Monitoring

- Monitoring can protect against the threat of hacking, which can introduce malware
- These can be used to protect against the threat of malware and hacking
  - Packet sniffers
  - User access logs

Prevention

- Up-to-date patches to the operating system and application programs reduce vulnerabilities in the system
- Up-to-date anti-malware (“anti-virus”) software can prevent the spread of infection



Worksheet 3

- Complete **Tasks 2 – 4**

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